Practice problems on Plancks theory and photoelectric effect(Level 1) updated

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practice on Plancks...

$3\times10^8 = \frac{60\times10^6\times10^3}{t}$

Planck's Quantum Theory, Photoelectric Effect

36. Small packets of light is called
(a) proton (b) quanta
(c) photon (d) spectrum

37. A radio station emits the radiations of 400 kHz. The metre band of station is $\to \lambda$?
(a) 400 (b) 750
(c) 1333.33 (d) 7.5

38. Which of the following electromagnetic radiation have greater frequency?
(a) X–rays
(b) Ultraviolet rays
(c) Radio waves
(d) Visible rays

39. As its closest approach, the distance between the Mars and the Earth is found to be 60 million km. When the planets are at this closest distance, how long would it take to send a radio massage from a space probe of Mars of Earth?
(a) 5 s (b) 200 s
(c) 0.2 s (d) 20 s

$60\times10^6\times10^3$ m

1 million = 10^6
1 Billion = 10^9

40. Two electromagnetic radiations have wave numbers in the ratio 2:3. Their energies per quanta will be in the ratio
(a) 3:2 (b) 9:4
(c) 4:9 (d) 2:3

41. A radio station is emitting the radiations of frequency 2×10^4 Hz. If its frequency is doubled,
(a) wavelength will be doubled
(b) energy per quanta will be doubled
(c) wave number will be halved
(d) all of these

per quanta → per photon

1 eV(electron Volt) = 1.6×10^{-19} Joule

1 Hz = 1 cps or s^{-1}
1 kHz = 10^3 Hz or 10^3 sec^{-1}

$E = \frac{hc}{\lambda} = hc\bar{\nu}$

$\frac{\bar{\nu}_1}{\bar{\nu}_2} = 2/3$

$\frac{E_1}{E_2} = \frac{h\bar{\nu}_1 c}{h\bar{\nu}_2 c} = 2/3$

42. The eyes of a certain member of the reptile family pass a single visual single to the brain when the visual receptors are stuck by photons of wavelength 662.6 nm. If a total energy of 3.0×10^{-14} J is required to trap the signal, what is the minimum number of photons that must strike the receptor?
(a) 1.0×10^5 (b) 1.0×10^6
(c) 1000 (d) 1

43. A photon of 400 nm is absorbed by a gas molecule and then the molecule re-emits two photons. One re-emitted photon has wavelength 500 nm. Assuming that there is no change in the energy of molecule, the wavelength of second re-emitted photon is
(a) 100 nm (b) 2000 nm
(c) –100 nm (d) 900 nm

44. A green bulb and a red bulb are emitting the radiations with equal power. The correct relation between numbers of photons emitted by the bulbs per second is
(a) $n_g = n_r$ (b) $n_g < n_r$
(c) $n_g > n_r$ (d) unpredictable

$(E_T)_g = (E_T)_r$
$n_g h\nu_g = n_r h\nu_r$
$\frac{n_g}{n_r} = \frac{\nu_r}{\nu_g}$
$\nu_r < \nu_g$
$\boxed{\frac{\nu_r}{\nu_g}} < 1$
$\frac{n_g}{n_r} < 1$
$\boxed{n_g < n_r}$

45. A dye emits 50% of the absorbed energy as fluorescence. If the number of quanta absorbed and emitted out is in the ratio 1:2 and it absorbs the radiation of wavelength 'x' Å, then the wavelength of the emitted radiation will be
(a) x Å (b) $0.5\,x$ Å
(c) $4x$ Å (d) $0.25\,x$ Å

46. Wavelength of photon which have energy equal to average of energy of photons with $\lambda_1 = 4000$ Å and $\lambda_2 = 6000$ Å will be
(a) 5000 Å (b) 4800 Å
(c) 9600 Å (d) 2400 Å

47. Bond dissociation on energy of Br_2 is 200 kJ/mole. The longest wavelength of photon that can break this bond would be ($N_A \times hc = 0.12$)
(a) 6.0×10^{-5} m (b) 1.2×10^{-5} m
(c) 6.0×10^{-7} m (d) 1.2×10^{-7} m

48. Wavelength of photon having energy 1 eV would be
(a) 1.24×10^{-4} m
(b) 1.24×10^{-6} m
(c) 1.24×10^{-5} m
(d) 1.24×10^{4} m

49. In the emission of photoelectrons, the number of photoelectrons emitted per unit time depends upon
(a) energy of the incident radiation
(b) intensity of the incident radiation
(c) frequency of the incident radiation
(d) wavelength of the incident radiation

50. Radiations of frequency, ν, are incident on a photosensitive metal. The maximum kinetic energy of photoelectrons is E. When the frequency of the incident radiations is doubled, what is the maximum kinetic energy of the photoelectrons?
(a) $2E$ (b) $E/2$
(c) $E + h\nu$ (d) $E - h\nu$

51. A photo sensitive surface is receiving light of wavelength 5000 Å at the rate of 10^{-7} J/s. The number of photons received per second is
(a) 2.5×10^{11} (b) 3.0×10^{32}
(c) 2.5×10^{18} (d) 2.5×10^{9}

52. In order to increase the kinetic energy of ejected photoelectrons, there should be an increase in
(a) intensity of radiation
(b) wavelength of radiation
(c) frequency of radiation
(d) both wavelength and intensity of radiation

45

$E_{ab} = E = n_a\frac{hc}{x}$

$n_e\frac{hc}{\lambda} = E_{emitted} = 50\%$ of $E_{ab} = \frac{1}{2}E_{ab}$

$\frac{n_a}{n_e} = \frac{1}{2}$

$n_e\frac{\cancel{h}c}{\lambda} = \frac{1}{2}\frac{n_a\cancel{h}c}{x}$

$\frac{1}{\lambda} = \frac{1}{2}\frac{n_a}{n_e}\frac{1}{x}$

$\frac{1}{\lambda} = \frac{1}{2\times2}\frac{1}{x}$

$\lambda = 4x$ A°

Planck's Quantum Theory, Photoelectric Effect

36. (c) 37. (b) 38. (a) 39. (b) 40. (d) 41. (b) 42. (a) 43. (b) 44. (b) 45. (c)
46. (b) 47. (c) 48. (b) 49. (b) 50. (c) 51. (a) 52. (c)